our revision of this genus.[2] *Fig. 3* is the fruit of *L. Schaffneriana*, and *fig. 4* that of *L. Carolinensis*, as the descriptions indicate.

Mr. Norton sends a specimen of our new species *L. Carolinensis* from New Orleans, collected by J. F. Joor. The only locality known to us was eastern North Carolina.

The eastern distribution of *L. lineata* is usually given as from Massachusetts to Mississippi, but we have never seen specimens west of Florida.

Collectors along the Gulf coast should endeavor to discover whether these two species are found there, and learn definitely their distribution. The flowers of Lilæopsis are always given as being white, but in *L. Carolinensis* Dr. Joor says they are pink.—JOHN M. COULTER and J. N. ROSE.

THE PHYSIOLOGICAL PROBLEMS OF TODAY.[3]

IF it be true that the fundamental problem of physics is the constitution of matter, it is equally true that the fundamental problem of physiology is the constitution of living matter. I think the time has come for physiology to return to its fundamental problem.

Living matter is a collective term for the quality common to all living organisms. Comparative physiology alone enables us to discriminate between the general properties of living matter and the functions of specific organs, such as the blood, the nerves, the sense organs, chlorophyll, etc. Nothing has retarded the progress of physiology and pathology more than the neglect of comparative physiology. Comparative physiology shows that secretion is a general function of all living organisms and occurs even where there is no circulation. Hence it was *a priori* false and a waste of time to attempt to explain secretion from the experiments on blood pressure. Oxidations occur regardless of circulation and it was *a priori* a waste of time to consider the blood as the seat of oxidation. Comparative physiology has shown that the reactions of animals to light are identical with the heliotropic phenomena in plants. Hence it is a mistake to ascribe such reactions as the flying of the moth into the flame to specific functions of the brain

[2] BOT. GAZ., 24: 48, 49. 1897.

[3] Delivered at the Ithaca meeting of the American Society of Naturalists, December 29, 1897. Dr. Loeb's paper is one of seven upon "The biological problems of today," each speaker being limited to ten minutes.

and the eyes. Sleep is a phenomenon which occurs in insects and plants, and it would be a waste of time to attempt an explanation of sleep on the basis of phenomena of circulation. The best interests of physiology and pathology demand that the systematic development of comparative physiology be one of the physiological problems of today.

May I be pardoned for calling attention to one special field of comparative physiology which I believe to be especially fertile. I refer to the field of physiological morphology. I applied this name to the investigation of the connection between the chemical changes and the process of organization in living matter. Two series of facts allow us to connect these two groups of phenomena: (1) the fact that phenomena of fermentation lead to an increase in the number of molecules and thus bring about an increase of osmotic pressure in the cells, this increase of osmotic pressure being the source of energy for the work of growth: (2) the facts of heteromorphosis, *i. e.*, the possibility of transforming in certain animals one organ into another or substituting one organ for another through external influences, such as gravitation, contact, light etc.

The exact and definite determination of life phenomena which are common to plants and animals is only one side of the physiological problem of today. The other side is the construction of a mental picture of the constitution of living matter from these general qualities. In this portion of our work we need the aid of physical chemistry and especially of three of its theories; stereochemistry, van 't Hoff's theory of osmotic pressures, and the theory of the dissociation of electrolytes. We know that the peculiar phenomena of oxidation in living matter are determined by fermentative processes, and we venture to say that fermentations form the basis of all life phenomena. It has been demonstrated that fermentability is a function of the geometrical configuration of the molecule. *Saccharomyces Cerevisiæ* is a ferment for such sugars only as have three or a mutiple of three atoms of carbon in the molecule. Among the hexaldoses only δ-glucose, δ-mannose, and δ-galactose are fermentable, while their stereoisomers are not fermentable. But the influence of the geometrical configuration goes farther. Voit has suggested and Cramer has demonstrated that there is a far-reaching parallelism between the fermentability and assimilation of carbohydrates. Higher animals as well as yeast cells are able to form glycogen from such carbohydrates as are fermentable by yeast. The further development of these stereochemical relations and their extension to

proteids and nucleins is another of the problems of physiology which will contribute to the main problem, the analysis of the constitution of living matter. I believe that the influence of stereochemistry will be more or less directly felt in many branches of physiology, in questions of heredity, as well as in the theory of space sensations as E. Mach has already intimated.

In living organisms chemical energy is frequently transformed into osmotic energy. Van 't Hoff's theory of osmotic pressure permits an application of the law of conservation of energy to a class of phenomena to which this law was hitherto inapplicable, namely the phenomena of growth, functional adaptation, secretion, absorption and even pathological processes such as œdema. The physiologists who thought that the blood pressure determined secretion could not understand why secretion took place under a higher pressure than the blood pressure. Comparative physiology shows that secretion does not depend upon circulation, and the theory of osmotic pressure indicates that the osmotic pressure in the cells is more than twenty times as high as the blood pressure. The work of secretion is done by osmotic pressure and not by blood pressure. A prominent physiological chemist has become a vitalist because he could not explain why the secretions differ from the blood from which he thinks they are formed. He overlooks among others the fact that the protoplasm possesses the quality of semi-permeability, which means that it allows certain substances to pass through and others not. In my opinion the working out of a theory of semi-permeability is one of the main physiological problems of the day.

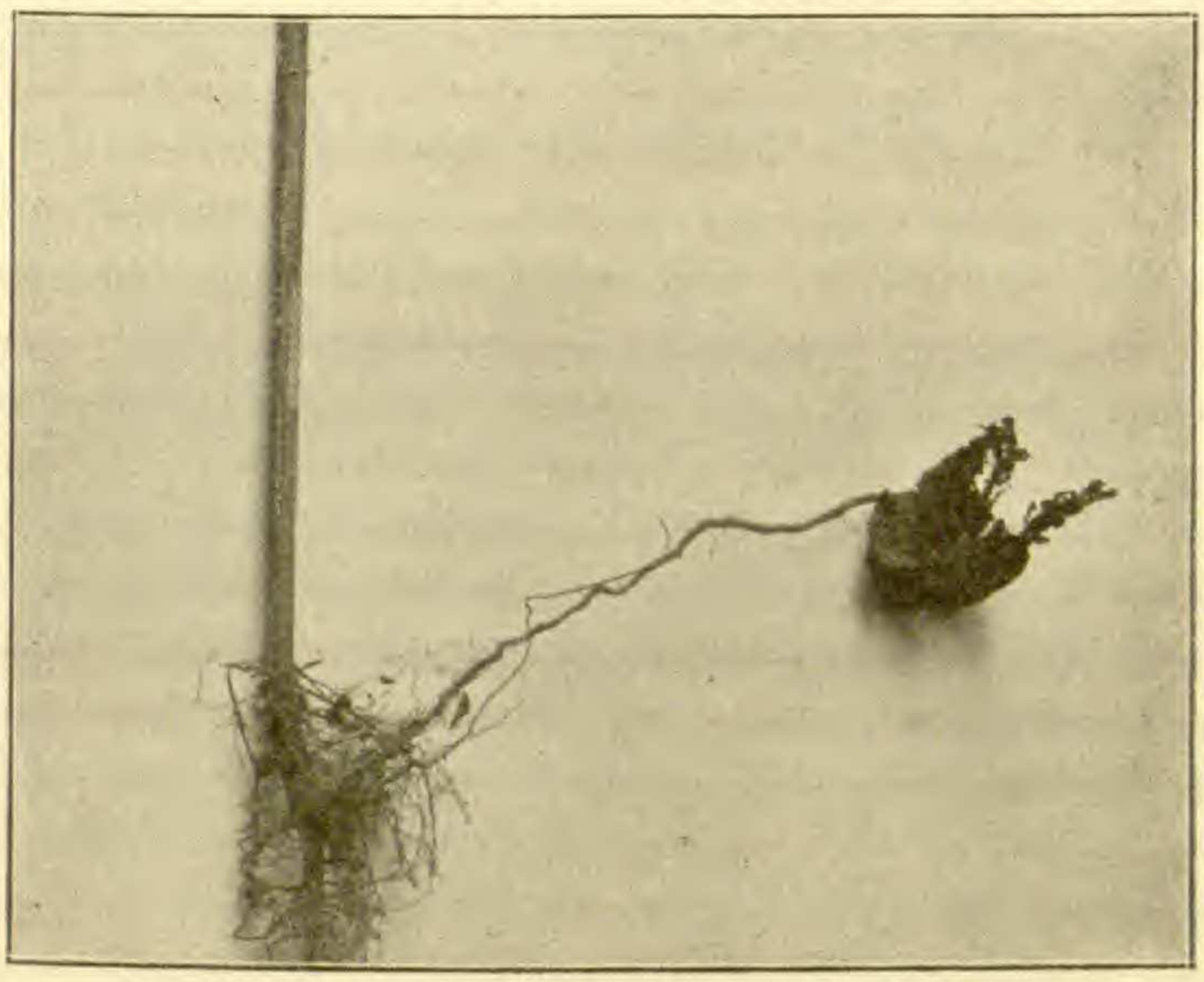
The theory of the dissociation of electrolytes is of fundamental importance in the analysis of the constitution of living matter. Pharmacology will feel its influence most directly. Everything seems to indicate that the specific physiological effects of inorganic acids are due to the number of positively charged hydrogen ions in the unit of solution, and the specific physiological effects of alkalies to the negatively charged hydroxyl ions. But the universal bearing of the theory of dissociation upon physiology will perhaps be best seen in the field of animal electricity. An active element of living matter in a state of rest is negatively electric to its surrounding parts. We may assume that an acid is formed in the active part and that the passive parts are neutral. The positive hydrogen ions of the acid have a much greater velocity of migration than the anions. Hence the former will

diffuse more rapidly into the passive tissue than the anions, and the active tissue will remain negatively charged.

At no time since the period immediately following the discovery of the law of conservation of energy has the outlook for the progress of physiology appeared brighter than at present. But in order to reap the full benefit of our opportunities we must bear in mind that the fundamental problem of physiology is the determination of the constitution of living matter, and that in order to accomplish our task we must make adequate use of comparative physiology as well as physical chemistry. Pathology, in particular, will be benefited by such a departure. — JACQUES LOEB, *The University of Chicago.*

APHYLLON LUDOVICIANUM ON AMBROSIA TRIFIDA.

I HAVE found the Louisiana naked broomrape to be one of the rare plants in this vicinity; but when found it has always been attached to



the roots of the great ragweed. The roots given out by the host, which connect the two plants, are at first small, so that it is almost impossible to trace them to their destination. But they steadily increase in size, until they are often as large as a wheat straw by the time the parasite has run its course, which is usually about the last of September. There is usually only one supply-root, and this is of nearly the same size its entire length, and a mat of small haustoria is